DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the fuel injection valve which injects high pressure fuel to a diesel power plant.
[0002]
[Description of the Prior Art]In recent years, in a diesel power plant etc., it will be necessary to cope with the control of exhaust gas and fuel consumption regulation which become severe. In order to attain reduction of the detrimental constituent contained in exhaust gas, and fuel consumption improvement, time and optimizing spatially and qualitatively are expected spraying by fuel injection. injection timing control highly precise in time -- spatial -- the improvement in spraying distribution -- microatomization of spraying is qualitatively required respectively. In each gazette of JP,53-71721,A and JP,57-183562,A, the fuel injection nozzle aiming at optimization of the above fuel injection is indicated.
[0003]In the fuel injection nozzle of the front gazette (JP,53-71721,A), the condom room which can be opened and closed by the pin formed at the tip of a needle, and the annular chamber which can be opened and closed according to the tapered surface of a needle to the upstream of this condom room were provided, and the respectively separate nozzle hole is established in the condom room and the annular chamber. And two steps of injections of the case where it is injected by the lift amount of a needle only from the nozzle hole of an annular chamber, and the case where it is injected from the nozzle hole of both an annular chamber and a condom room are enabled, and NOx and white smoke formation are reduced as much as possible by changing an injection state according to the operational status of an internal-combustion engine. In the fuel injection nozzle of a back gazette (JP,57-183562,A), a hole is vacated at the tip of a condom room other than the orifice opened and closed by the tapered surface of a needle, the pin part at the tip of a needle is inserted in this hole, and the circular nozzle hole is formed in the periphery of a pin part. Since it is injected towards the high temperature region of a combustion chamber, an ignition delay is shortened, and since the spraying from this circular nozzle hole can realize loose combustion, it can reduce combustion vibration.

[0004]
[Problem to be solved by the invention]However, although NOx and white smoke formation can be reduced by two-step injection in the fuel injection nozzle of a front gazette, under the present circumstances, it is insufficient for coping with still severe control of exhaust gas for the following Reason.
1) With a raise in injection pressure in recent years, the accomplishment power of spraying improves and spraying collides with a cylinder or a piston wall surface, and since soot adheres on a wall surface and it is discharged by the atmosphere with exhaust gas, it becomes air pollution.
2) In the present hole nozzle hole, since the field where spraying does not exist produces between nozzle holes even if it forms two or more nozzle holes, combustion air cannot be used effectively. On the other hand, in the fuel injection nozzle of a back gazette, if a needle carries out a lift, spraying from an orifice and spraying from a circular nozzle hole will be performed simultaneously. For this reason, an initial injection rate becomes high and NOx increases. Accomplishing this invention based on the above-mentioned situation, the purpose is to provide the fuel injection valve which two-step injection is possible and can diffuse spraying in the high range.
[0005]
[Means for solving problem]
(Means of Claim 1) The pin part provided at the tip of a needle, An outer diameter is smaller than the seal part which ****s to the inner skin of the breakthrough formed in the nozzle body, and this seal part, It has a narrow diameter portion which projects to a tip and forms an annular nozzle hole between breakthroughs from a seal part, and the seal length of the seal part is set up smaller than a maximum lift amount more greatly than the initial lift amount of a needle. Thereby, if a needle carries out the lift only of the initial lift amount, the high pressure fuel which flowed into the condom room will be injected from a hole nozzle hole. Since the seal part is in slide contact with the inner skin of a breakthrough at this time, between a condom room and annular nozzle holes (crevice formed between a breakthrough and a narrow diameter portion) is intercepted, and fuel does not flow into an annular nozzle hole from a condom room. Then, if a needle carries out a lift to a maximum lift amount, when a seal part separates from the inner skin of a breakthrough, a condom room and an annular nozzle hole will be open for free passage. As a result, the fuel which flowed from the condom room is injected also from an annular nozzle hole with spraying from a hole nozzle hole.
[0006]In this case, although cylindrical spraying is injected from a hole nozzle hole in the 1st step of injection, since it is injection comparatively in low pressure at this time, accomplishment power is weak and fuel adhesion to a piston wall surface or a cylinder can be avoided. In the 2nd step of injection, in addition to a hole nozzle hole, fuel injection is carried out also from an annular nozzle hole, but since it is injected with high voltage at this time, accomplishment power can be weakened by making a nozzle hole annular. Since an initial injection rate (the 1st step of injection quantity) can be reduced by considering it as 2 step injection, discharge NOx can be reduced.
[0007](Means of Claim 2) A limb which spreads in the shape of an umbrella is provided at a tip of a pin part at which a needle projects from a breakthrough.In this case, since spraying injected from an annular nozzle hole spreads in the shape of an umbrella by a limb, spraying can be diffused more in a large area. As a result, since it can be spread in

the whole combustion chamber, combustion air can fully be used and reduction and fuel consumption improvement of white smoke can be realized. Since accomplishment power also declines by spraying being spread broadly, fuel adhesion to a piston wall surface or a cylinder can be avoided, and discharge of soot can be controlled.

[0008]

[Mode for carrying out the invention]Next, a fuel injection valve of this invention is explained based on Drawings. Drawing 1 is an expanded sectional view of a nozzle tip part. As shown in drawing 2, the fuel injection valve 1 of this example is used for a direct fuel-injection engine, and injects high pressure fuel fed through the injection pipe 3 from the fuel injection pump 2 to the engine combustion chamber 4. This fuel injection valve 1 comprises the 1st spring 9 and 2nd spring 10 grade which set a nozzle which comprises the needle 6, the nozzle holder 8 which holds this nozzle by clamping force of the retaining nut 7, and an injection-valve opening pressure to the nozzle body 5.

[0009]The communication hole 13 which opens for free passage the 1st spring chamber houses 11 which accommodate the 1st spring 9 in the upper part side, the 2nd spring chamber houses 12 which accommodate the 2nd spring 10 in the lower part side, and both the chamber houses 11 and 12 is formed in the inside of the nozzle holder 8. The fuel path 15 which extends to the lower end surface of the nozzle holder 8 through the inside of the inlet 14 to which the injection pipe 3 is connected is established in the nozzle holder 8. The 1st spring 9 sets up the 1st injection-valve opening pressure of the needle 6, and is energizing the needle 6 through the rod 16. The 2nd spring 10 sets up the 2nd injection-valve opening pressure with the 1st spring 9, and is energizing the spacer 17 accommodated in the lower end part of the 2nd spring chamber houses 12 below (nozzle side).

[0010]Ranging over both the chamber houses 11 and 12, it is accommodated through the communication hole 13, a lower end part is provided in a byway, and the rod 16 is inserted in the breakthrough 17a which penetrates the center section of the spacer 17 (refer to drawing 3). The spacer 17 is formed in the annular solid which comprises the major diameter 17b and the narrow diameter portion 17c centering on the breakthrough 17a, as shown in drawing 3. This spacer 17 was located in the upper part side of the chip packing 18 with which the major diameter 17b intervenes between the nozzle holder 8 and the nozzle body 5, was slidably inserted in the round hole 18a by which the narrow diameter portion 17c was vacated for the center section of the chip packing 18, and is projected to the nozzle body 5 side. Thereby, in contact with the chip packing 18, movement in a graphic display lower part is regulated for the major diameter 17b by which the spacer 17 was energized by the 2nd spring 10. When the needle 6 carries out the lift of the chip packing 18, it regulates maximum lift amount HD2 of the needle 6 because the upper bed side of the needle 6 (major diameter axis part 23) contacts the lower end surface of the chip packing 18. The fuel path 18b (refer to drawing 2) leading to the fuel path 15 of the nozzle holder 8 is penetrated and formed in the board thickness direction at this chip packing 18.

[0011]The fuel path 21 grade in which the nozzle body 5 leads fuel to the long hole 19 which stores the needle 6 on a medial axis, the annular reserve-well room 20 provided in the middle of the long hole 19, and this reserve-well room 20 is provided. This fuel path 21 is open for free passage to the fuel path 18b established in the chip packing 18. The needle 6 is formed in long and slender cylindrical shape with the stage, and it is

constituted so that the height 22, the major diameter axis part 23, the minor diameter axis part 24, and a point (it mentions later) may be located on the same axle toward the lower end side from the upper bed side. The height 22 is in contact with the lower end surface of the rod 16 where it is inserted in the breakthrough 17a from the lower part side of the spacer 17, and the upper bed side is similarly inserted in the breakthrough 17a, as shown in drawing 3. The major diameter axis part 23 is slidably inserted in the long hole 19 above the reserve-well room 20, at the time of the operation of the needle 6, makes inner skin of the long hole 19 a guide surface, and carries out vertical movement. The crevice between some is secured between the upper bed side of the major diameter axis part 23, and the lower end surface of the narrow diameter portion 17c of the spacer 17, and this crevice is set to initial lift amount HD1 of the needle 6 (refer to drawing 3). The minor diameter axis part 24 is stored by the long hole 19 below the reserve-well room 20, and the annular crevice (henceforth the fuel path 25) is formed between the long hole 19.

[0012]If the fuel pressure which the taper part 26 (refer to drawing 2) is formed between the major diameter axis part 23 and the minor diameter axis part 24, and is added to this taper part 26 exceeds the 1st injection-valve opening pressure (energization force of the 1st spring 9), this needle 6, If the lift only of initial lift amount HD1 is carried out, and also fuel pressure rises and it exceeds the 2nd injection-valve opening pressure (total load of the 1st spring 9 and the 2nd spring 10), resisting the energization force of the 1st spring 9 and pushing up the rod 16, A lift can be carried out to maximum lift amount HD2, resisting the synthetic energization force of the 1st spring 9 and the 2nd spring 10, and pushing up the rod 16 and the spacer 17.

[0013]Next, the composition of the nozzle tip part which is the feature of this example is explained based on drawing 1. The cone wall surface 27 which becomes depressed in conical shape from the lower end surface of the long hole 19, the condom room 28 where this cone wall surface 27 continues caudad, two or more hole nozzle holes 29 which lead to this condom room 28, and the breakthrough 30 penetrated from the bottom of the condom room 28 to the exterior are formed in the nozzle body 5. The sheet part 31 which sits down on the cone wall surface 27 of the nozzle body 5 is formed in the point of the needle 6, The cone part 32 whose diameter is reduced to conical shape is downstream formed from this sheet part 31, and also the cylinder part 33 (seal part of this invention) inserted in the breakthrough 30 of the nozzle body 5 through the condom room 28 is formed downstream from the cone part 32. This cylinder part 33 is formed in a slidable size to the breakthrough 30 of the nozzle body 5, and both clearance is managed by several micrometers. Therefore, the breakthrough 30 is closed by the cylinder part 33 by the cylinder part 33 being inserted. however, the immersion depth, i.e., seal length LS, of the cylinder part 33 inserted in the breakthrough 30 in the state (state shown in drawing 1) where the sheet part 31 has sat down on the cone wall surface 27 of the nozzle body 5. It is set as the value (for example, about 0.1-0.5 mm) smaller than maximum lift amount HD2 more greatly than initial lift amount HD1 of the needle 6.

[0014]The narrow diameter portion 35 which forms an annular crevice (henceforth the annular nozzle hole 34) between the breakthroughs 30 from the cylinder part 33 in a byway is formed downstream from the cylinder part 33. Downstream, the cone part 36, the constricted portion 37, and the umbrella part 38 are formed in order from the narrow diameter portion 35. As shown in drawing 1, this umbrella part 38 jumps out of the breakthrough 30, from the constricted portion 37, is expanded rapidly in the shape of an

umbrella, is formed, and serves as a parameter with which the difference angle alpha of that tapered surface to expand controls the dispersion direction of spraying injected from the annular nozzle hole 34. The maximum external diameter of the umbrella part 38 is set up smaller than the outer diameter of the cylinder part 33.

[0015]Next, the operation of this example is explained. The fuel of the specified quantity is fed from the fuel injection pump 2 at a predetermined stage, and the high pressure fuel is supplied to the fuel injection valve 1 through the injection pipe 3. In the fuel injection valve 1, it is introduced into the fuel path 15 from the injection pipe 3 connected to the inlet 14 of the nozzle holder 8, It flows in from the fuel path 15 to the upper stream of the sheet part 31 via the fuel path 25 formed in the circumference of the fuel path 21 -> reserve-well room 20 -> minor diameter axis part 24 of the fuel path 18b-> nozzle body 5 of the chip packing 18. If the pressure (fuel pressure added to the taper part 26 of the needle 6) of the fuel stored in the reserve-well room 20 rises here and it becomes higher than the 1st injection-valve opening pressure (energization force of the 1st spring 9), While the needle 6 resists the energization force of the 1st spring 9 and pushes up the rod 16, a lift is carried out to initial lift amount HD1. Thereby, in order that the sheet part 31 of the needle 6 may estrange from the cone wall surface 27 of the nozzle body 5, high pressure fuel flows into the condom room 28, and it is injected by the combustion chamber 4 from the hole nozzle hole 29 (the 1st step injection).

[0016]Since the cylinder part 33 of the needle 6 is still inserted into the breakthrough 30 and is carrying out the seal of between the condom room 28 and the annular nozzle holes 34 at the time of this initial lift, fuel injection is not performed from the annular nozzle hole 34, and fuel injection is performed only from the hole nozzle hole 29. Spraying injected from the hole nozzle hole 29 turns into cylindrical spraying, as shown in drawing 4, but since it is injection comparatively in low pressure, its accomplishment power is weak and it can avoid fuel adhesion to a wall surface of the piston P and the cylinder S.

[0017]Then, if fuel pressure in the reserve-well room 20 rises and it becomes higher than the 2nd injection-valve opening pressure (sum of energization force of the 1st spring 9 and the 2nd spring 10), while the needle 6 also pushes up the spacer 17 with the rod 16, a lift will be carried out to maximum lift amount HD2. In order that the cylinder part 33 of the needle 6 may escape from and come out of the breakthrough 30 and the condom room 28 and the annular nozzle hole 34 may be open for free passage by this, fuel which flowed from the condom room 28 is injected also from the annular nozzle hole 34 with fuel injection from the hole nozzle hole 29 (the 2nd step injection). Spraying injected from this annular nozzle hole 34 is diffused by the umbrella part 38 provided in a point of the needle 6, and turns into umbrella-like spraying (refer to drawing 5). Since fuel pressure in the reserve-well room 20 will decline if the 2nd step injection is performed, the needle 6 is depressed in response to synthetic energization force of the 1st spring 9 and the 2nd spring 10, and fuel injection is completed because the sheet part 31 of the needle 6 sits down on the cone wall surface 27 of the nozzle body 5.

[0018](Effect of this example) According to this example, although cylindrical spraying is injected from the hole nozzle hole 29 by the 1st step injection, since it is injection comparatively in low pressure at this time, accomplishment power is weak and the fuel adhesion to the piston P and the cylinder S can be avoided. As a result, the air pollution by discharge of the soot to the inside of the atmosphere can be prevented, without soot adhering to the wall surface of the piston P, etc. In the 2nd step injection, in addition to

the hole nozzle hole 29, fuel injection is carried out also from the annular nozzle hole 34, but since the injection from the annular nozzle hole 34 is broadly spread by the umbrella part 38 provided in the point of the needle 6 and serves as umbrella-like spraying (refer to drawing 5), accomplishment power of spraying can be weakened in spite of the injection in high voltage. Since it can be spread in the combustion chamber 4 whole by injecting umbrella-like spraying from the annular nozzle hole 34, combustion air can fully be used and reduction and fuel consumption improvement of white smoke can be realized. Since an initial injection rate (the 1st step of injection quantity) can be reduced by considering it as 2 step injection, discharge NOx can be reduced.

CLAIMS

[Claim(s)]
[Claim 1]A breakthrough which has a condom room inside a tip and is penetrated from a pars basilaris ossis occipitalis of this condom room to the exterior, and a nozzle body in which two or more hole nozzle holes were formed in the upstream from this breakthrough.
A pin part which is slidably stored by this nozzle body and is inserted at a tip into said breakthrough through said condom room.
Are the above the fuel injection valve which it had, and said pin part, An outer diameter is smaller than a seal part which ****s to inner skin of said breakthrough, and this seal part, It has a narrow diameter portion which projects to a tip and forms an annular nozzle hole between said breakthroughs from said seal part, and seal length of said seal part is set up smaller than a maximum lift amount more greatly than an initial lift amount of said needle.

[Claim 2]A fuel injection valve which said needle indicated to Claim 1, wherein a limb which spreads in the shape of an umbrella is provided at a tip of said pin part which projects from said breakthrough.

[Translation done.]